U. S. FOREST SERVICE

RESEARCH NOTE LS-33

E STATES FOREST EXPERIMENT STATION • U. S. DEPARTMENT OF AGRICULTURE

Root Development of Yellow Birch in Humus and a Sandy Loam

During a study of the effects of various environments on yellow birch behavior, it was observed that the birch often established itself on the border of the plots between the humus and surrounding mineral soil. A few plants were excavated and the rooting habit examined. Most of them showed the greatest development of rootlets in the humus.

Redmond, seeking soil for optimum root development, found that the roots of young yellow birch seedlings developed in loam but remained undeveloped in sand.[1] He attributed this to the greater nutrient content of the loam. Redmond also found that a high portion of yellow birch rootlets was in the humus layer in various forest environments.[2]

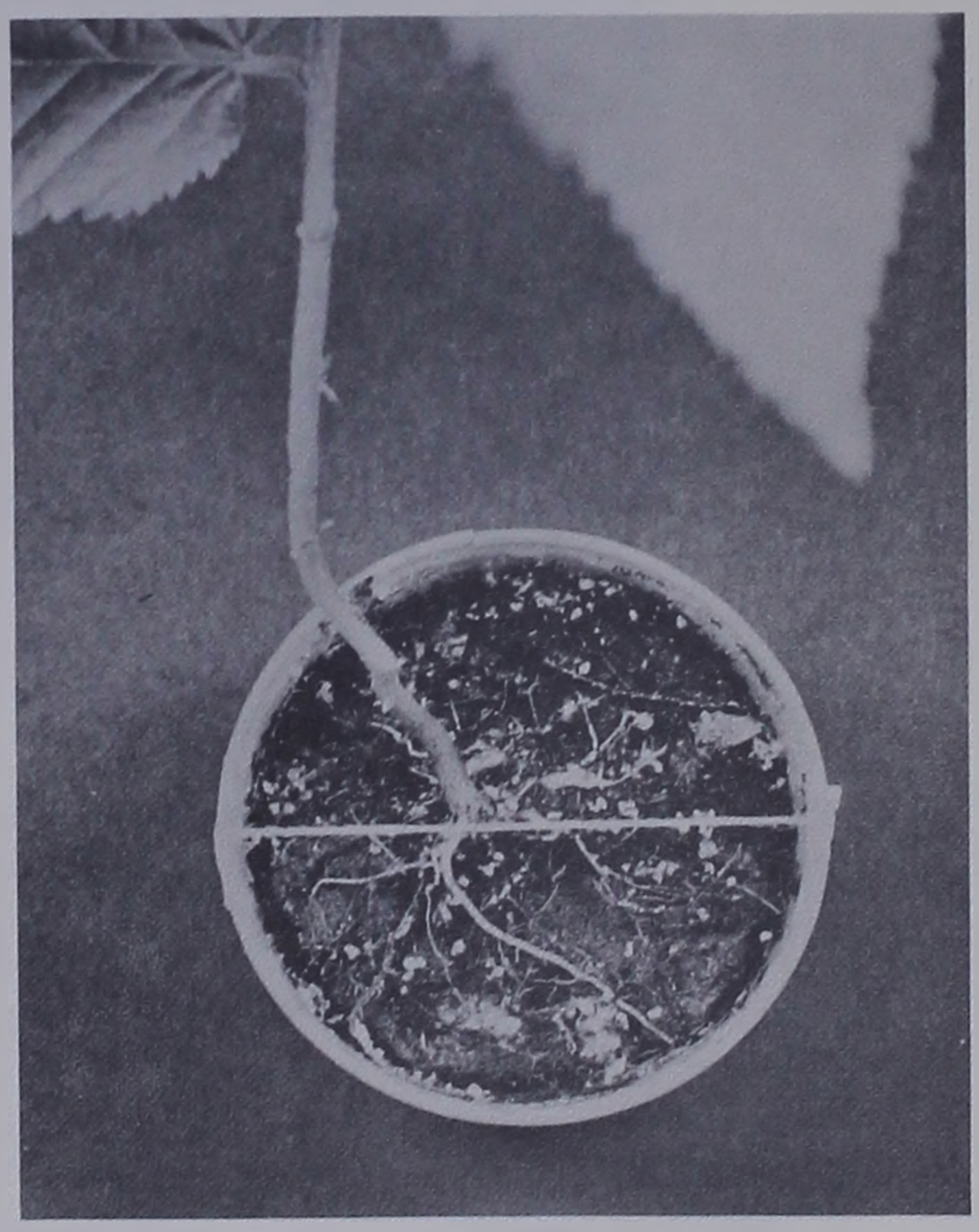
To determine whether root production is better in humus than in sandy loam, a test was established in the greenhouse.

Twenty 4-inch plastic pots were filled so that half of each pot contained mineral soil, and half humus (fig. 1). The mineral soil was a sandy loam[3] from the B horizon under a hemlock-hardwood stand. The humus, taken from a mixed hardwood stand, was crumbled up before using.

Two-year-old yellow birch wildlings, growing in mineral soil of a hemlock-hardwood stand, were lifted and their roots spread evenly over both media. Perlite was spread over the top of the roots and kept moist. Pots were kept on a greenhouse bench with a 10-hour-day fluorescent light source. Lights were cool white type (40 watts) and were 2½ feet above the table level.

Half the pots were fertilized with a commercial fertilizer solution containing 7 percent N, 6 percent P, and 19 percent K. Pots were watered from above for 3 weeks and thereafter from below.

After 45 days the roots in 10 pots were washed from the soil. Tops showed a definite response to



F-504579

FIGURE 1. — Four-inch plastic pots were filled, half with a sandy loam and half with humus (white line marks division between media), and roots were spread over both sides.

---

[1] *Redmond, D. R. Variations in development of yellow birch roots in two soil types. Forestry Chron. 30: 401-406, illus. 1954.*

[2] *Redmond, D. R. Observations on rootlet development in yellow birch. Forestry Chron. 33: 208-212. 1957.*

[3] *Texture breakdown in percent was as follows:*

Larger than 1 mm — fine gravel	3
1-.5 mm — coarse sand	23
.5-.25 mm — medium sand	19
.25-.05 mm — fine and very fine sand	33
Smaller than .05 mm	22

MAINTAINED AT ST. PAUL 1, MINNESOTA, IN COOPERATION WITH THE UNIVERSITY OF MINNESOTA

F-504577, 504578

FIGURE 2. — Two typical examples of root development. The rootlets at the left side of each of these plants were in humus; those on the right side of each plant were in mineral soil.

the fertilizer (fertilized trees grew an average of 257 mm in 45 days while unfertilized trees grew only 141 mm); but the greatest development of roots was in the humus section (fig. 2) in 9 of the 10 pots regardless of fertilization. Results were so obvious that weights were not recorded.

Thereafter, the previously unfertilized pots were fertilized with the same solution on the mineral soil side only in an attempt to induce the development of roots on the mineral side. After 3 months the remaining plants were removed from the pots and washed. Again root production was best in the humus section in 9 of the 10 pots. Roots did not develop on the mineral side except for those moving down the pot wall. Even these had a propensity to move to the humus side. Roots in the two pots that had equally good development in both mineral and humus appeared to have originated primarily in the humus.

To summarize: Yellow birch seedlings with roots placed in a sandy loam and in humus developed best in the humus in 18 of 20 pots. Pots were fertilized in various ways in an attempt to stimulate development in the mineral soil without success.

CARL H. TUBBS
Research Forester
(Forest Management)

October 1963